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1999

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Extension Number: ASL R1616

Recommended Citation

Wiegand, B. R.; Parrish, Frederick C. Jr.; Franey, K. J.; Larsen, S. T.; and Sparks, J. Christopher, "Water Holding Capacity, pH, and Lipid Oxidation of Pork Loins from Barrows Supplemented with Conjugated Linoleic Acid" (1999). *Swine Research Report, 1998*. 70. http://lib.dr.iastate.edu/swinereports_1998/70

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Water Holding Capacity, pH, and Lipid Oxidation of Pork Loins from Barrows Supplemented with Conjugated Linoleic Acid

Abstract

An ongoing research project is investigating the feeding of conjugated linoleic acid (CLA) to pigs and the subsequent effects of CLA on growth, performance, and pork quality characteristics. Certain measures of pork meat samples, including pH, water holding capacity and lipid oxidation are proven indicators of pork quality. The CLA was fed to market barrows at 0.75% of the diet from 40 kg to 115 kg of body weight. No treatment differences were observed for pH or water holding capacity measures over three periods (1, 14, and 28 days) of retail storage. No treatment differences were observed for lipid oxidation at 14 and 28 days of retail storage. Pork chops from CLA- treated pigs exhibited less lipid oxidation ($P < .05$) than control chops at 1 day of retail storage. These measures of pork quality were all within acceptable levels for retail sale. Supplementation of CLA in swine finishing diets did not compromise pork quality characteristics and even decreased lipid oxidation in early stages of retail storage.

Keywords

ASL R1616

Disciplines

Agriculture | Animal Sciences

Water Holding Capacity, pH, and Lipid Oxidation of Pork Loins from Barrows Supplemented with Conjugated Linoleic Acid

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ASL-R1616

Summary and Implications

An ongoing research project is investigating the feeding of conjugated linoleic acid (CLA) to pigs and the subsequent effects of CLA on growth, performance, and pork quality characteristics. Certain measures of pork meat samples, including pH, water holding capacity and lipid oxidation are proven indicators of pork quality. The CLA was fed to market barrows at 0.75% of the diet from 40 kg to 115 kg of body weight. No treatment differences were observed for pH or water holding capacity measures over three periods (1, 14, and 28 days) of retail storage. No treatment differences were observed for lipid oxidation at 14 and 28 days of retail storage. Pork chops from CLA- treated pigs exhibited less lipid oxidation ($P < .05$) than control chops at 1 day of retail storage. These measures of pork quality were all within acceptable levels for retail sale. Supplementation of CLA in swine finishing diets did not compromise pork quality characteristics and even decreased lipid oxidation in early stages of retail storage.

Materials and Methods

Whole bone-in loins from 46 Landrace \times Yorkshire \times Duroc \times Hampshire barrows were used for this phase of the ongoing CLA project at ISU. These loins were either from control diet animals or CLA at 0.75% in the finishing diet. All pigs were started on their respective

diets at 40 kg of body weight. Pigs were slaughtered at Hormel in Austin, MN, in two slaughter groups. All pigs averaged 115 kg of body weight at slaughter. Whole bone-in loins were removed from the left side of the carcass at 24 hours postmortem. Loins were boxed and

sent to ISU meat laboratory under refrigerated conditions. At 48 hours postmortem, loins were deboned and cut into 2.54-cm-thick chops. Chops were packaged in pairs in Viskase® vacuum bags and stored at 2°C for 1, 14, and 28 days of retail storage. Also, 1.27-cm chops were cut and packaged under vacuum for measures of pH, water holding capacity (WHC), and lipid oxidation at the three storage times. A pH measurement was made with a lab top pH meter (Fisher Accumet 925) by using a 10-g ground meat sample in 100 ml of distilled water. Duplicate pH samples were used for each loin at each day. The ability of meat to bind water, (WHC), was measured according to the Carver Press method. This method utilizes a 0.3 g meat sample that is pressed at 3,000 psi for 3 minutes on a 125-mm filter paper. Two distinct areas are produced and include a meat area and a water area. The WHC is the ratio of the water to meat areas. Lower ratios are desired, indicating the ability of the sample to bind more water. Finally, lipid oxidation was measured using thiobarbituric acid (TBA) methodology. Oxidation products are measured with a mass spectrophotometer at 532 nm. The TBA values are reported as milligrams of malonaldehyde per kilogram of sample. Statistical analysis was performed with the GLM procedure of SAS. The model included fixed effects of treatment, replication, and day of retail storage. Least squares means were considered different at a P-value of 0.05 or less.

Results and Discussion

Least squares means and standard errors for pH, water holding capacity (WHC), and lipid oxidation (TBA) are shown in Table 1. No treatment differences were observed for pH. All pH levels were considered highly acceptable regardless of treatment and ranged from 5.70 to 5.80. Additionally, pH did not change over time of retail storage. Numerous studies have shown pH to be an indicator of pork quality, specifically pale, soft, and exudative (PSE) pork. Low pH (< 5.4) corresponds to a propensity toward PSE pork. The high pH values in this study are an indication of high- quality pork. The WHC was not effected by supplementation of CLA in the diet and did not change over retail storage time. Furthermore, all pork loins had acceptable WHC regardless of treatment. These

WHC data were supported by the absence of PSE loins in the study. Differences were observed ($p < .05$) at day 1 of retail storage for TBA values with means of 0.098 and 0.081 for control and CLA diets, respectively. No differences, however, were observed at days 14 and 28 of retail storage. These results indicate that CLA seems to slow lipid oxidation early in the storage period but has little antioxidant effect at longer storage periods

Conclusions

We believe the lack of differences for pH and WHC of CLA pork is positive. These results

indicate that supplementation of CLA in swine diets could positively effect some measures of pork quality. This is important because other work at ISU has shown improvements in growth and performance characteristics of pigs fed CLA. Also, the differences observed in TBA values at day 1 may indicate a slowing of lipid oxidation early in retail storage periods. Additional research is under way at ISU to examine more closely these measures of pork quality with regard to CLA supplementation to growing-finishing pigs.

Table 1. Least squares means and standard errors for pH, water holding capacity (WHC), and thiobarbituric TBA values at 1, 14, and 28 days of storage.

Trt	Day	pH	SE	WHC	SE	TBA ^c	SE
1	1	5.70	0.02	3.10	0.16	0.098a	0.003
4	1	5.70	0.02	3.03	0.16	0.081b	0.003
1	14	5.80	0.02	2.77	0.16	0.098	0.038
4	14	5.79	0.02	2.92	0.16	0.158	0.038
1	28	5.77	0.02	2.59	0.13	0.187	0.041
4	28	5.76	0.02	2.39	0.13	0.132	0.041

Means with different letter within a column are significant at $P < .05$.

^c TBA values expressed as milligrams of malonaldehyde per kilogram sample.